Emergency Shelters

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Carbon Monoxide Kills

Symptoms relating to CO concentration

- 50% COHb: Brain Damage - Death
- 45% COHb: Coma and brain damage
- 40% COHb: Collapse
- 35% COHb: Vomiting
- 30% COHb: Drowsy
- 25% COHb: Headache and Nausea
- 20% COHb: Headache
- 15% COHb: Slight Headache
- 10% COHb: None
- 5% COHb: None

ESCAPE!
Shelter is Last Resort
WV §56-4

- Provide an alternative to barricading for miners who have tried to escape and couldn't – SHELTER IS LAST RESORT
- Within 1,000 feet of working face
- Provide life-support for maximum likely number of miners on section
- Currently approved 8 models from 7 all undergoing MSHA national approval testing
- Shelter Plans submitted 4-16-2007 last shelter delivered 10-2009
Structural Requirements

15 PSI Overpressure

300°F Flash Fire

15 psi with 10x exaggeration of deformation
Structural Testing

Results have been validated by subsequent physical testing

Computational Finite Element Modeling Required

15 psi

30 psi
Life-Support Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption of oxygen (O₂)</td>
<td>0.4 l/min</td>
<td>(person in a rested mode)</td>
</tr>
<tr>
<td>Output of CO₂</td>
<td>0.4 l/min</td>
<td>(person in a rested mode)</td>
</tr>
<tr>
<td>Respiratory quotient</td>
<td>1.0</td>
<td>(uptake of O₂ is equal to CO₂ production)</td>
</tr>
<tr>
<td>Heat emission</td>
<td>100 W</td>
<td>(constant between 25°C and 30°C)</td>
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<tr>
<td>Humidity emission</td>
<td>1.5 l/day</td>
<td>(person in a rested mode)</td>
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</tbody>
</table>

Asking for Minimum 48 hours

Got 96 hours plus
Mine Shield™

1. Coveralls
2. Bumper pads
3. Communication System
4. Airlock Chamber
5. Reinforced Steel Construction
6. Padded Cushion
7. Additional Soda Lime Cartridges
8. Led Lights
9. I pod, games, etc
10. Fitted panels
11. Food Storage
12. Powder coated panels inside and out
13. Tanks
14. Reinforced Roll Cage
15. Compressed Air / Manifold System
16. Maintenance Door

17. Modular Construction
18. Circulating System
19. Battery Packs
20. 20. Repair Kit
21. 21 First Aid Equipment
22. Gas Monitoring System
23. Additional Storage
24. Outside Gas Sensor
25. Air Tight Door
26. Air Purge
27. Gas Monitor
28. Purge System
29. Chemical Toilet
30. Air Tight Doors
31. Sliding Tray With Mounts
32. Gas Monitoring System
33. Additional Storage
34. Outside Gas Sensor
35. Air Tight Door
36. Air Purge
37. Gas Monitor
38. Purge System
39. Chemical Toilet
40. Air Tight Doors
41. Sliding Tray With Mounts
ChemBio™

Packed Shelter

Air Tanks

Oxygen Tanks

Oxygen, Food, Water & Additional Supplies
UBB

Strata Fresh Air Bay closest to tail piece was damaged with the corners turned up as if it was hit by a machine or other large debris.

The unit had been exposed to high temperatures as the paint was burned and peeled on parts of the unit.

Fresh Air Bay that were further away had apparent shrapnel (like hail storm) damage and some showed signs of heat buckling but no viable heat damage to paint.

It appears the units behaved as expected. The ones where survivors might have reached survived and the one where they could not have survived suffered their fate.

As soon as investigation allows they will be deployed and inspected.